TWENTIETH ANNUAL REPORT OF THE DIRECTOR.

SUBMITTED TO THE TRUSTEES JANUARY 13, 1909.

To the Board of Trustees of the Missouri Botanical Garden:

The following report on the Missouri Botanical Garden and the School of Botany therewith connected is respectfully submitted, in compliance with your rules.

The completion of the twentieth fiscal year of the Board's administration (the first year comprising the last four months, only, of the calendar year 1889), causes me to make this report generally retrospective, in addition to reporting in detail on the year just closed. For comparison, apart from the detailed statement annually submitted and published in the Report of the Garden, special reference is made to the first volume of the Report,* which gives at length the earlier history of the establishment; to the eighth,† tenth ‡ and fifteenth § administrative reports, which are comparative; and to the seventeenth¶ report of the Officers of the Board, which passes in review the years 1889 to 1904.

In addition to the declaration of purposes in Henry Shaw's will,*[1] in the deed conveying certain property to Washington University for the support of the School of Botany†[1] and the acceptance of the same by the University authorities,‡[1] and in the program outlined for the School of Botany when opened,§[1] the policy of the Board and the plans of the Director have been set forth at some length, though necessarily in general terms, in the first, eighth, and seventeenth administrative reports.*[2] Year by year during the two decades now closed, these purposes and policies have been passed in thoughtful

---

* Rept. Mo. Bot. Gard. **1.** (1890).
† *l. c.* **8 :** 12–50. (1897).
‡ *l. c.* **10 :** 12–34. (1899).
§ *l. c.* **15 :** 13–37. (1904).
¶ *l. c.* **17 :** 7–27. (1906).
*[1] *l. c.* **1 :** 29–55. (1890).
†[1] *l. c.* **1 :** 56–58.
‡[1] *l. c.* **1 :** 59–62.
§[1] *l. c.* **1 :** 63–83.
*[2] *l. c.* **1 :** 92–98. **8 :** 37–46. **17 :** 23–24.

DWARF SUMACH, RHUS MICHAUXII.

review. If, in any essential, they are unrealized, this has resulted from necessity rather than forgetfulness or disregard; but, through causes beyond the control of the Board or Director, the possibility of detailed realization still remains greatly limited. Apart from the maintenance of a public museum as a part of the Garden, no general feature of the plan has actually failed of development in a degree proportionate to the financial possibilities of the Board; and, small as individual accomplishments have been, because of the limited means that could be bent to them, a continued and continuing advance is observable in all.

Recapitulated briefly, in the language used ten years ago, the direct objects of the founder of the Garden are: the maintenance of a garden easily accessible to the public excepting on Sundays and holidays, for the cultivation, propagation and study of plants; the exchange of material; the equipment, maintenance and utilization of a museum, herbarium and library; the gathering about the institution of a corps of instructors and investigators, with suitable laboratory and instrumental equipment; the provision for public lectures from time to time; the prosecution of research in botany in the broadest sense, including vegetable physiology, the diseases and injuries of plants, and horticulture and other branches of science closely connected with these; and the instruction and training of gardeners. Correlated with these purposes is that of training botanists, entrusted to the School of Botany, in the closest possible affiliation with the Garden.

GARDENING.

Under the administration of the Trustees, ever since the task fell to them, the Garden has been kept open to the public in the way designated by its founder, and, though never above criticism, has been maintained with improving taste and attractiveness, and with an increasing variety of plants under cultivation.

The limitation of decorative gardening to an area fixed at the time when the Trustees assumed charge of the establishment, and susceptible of enlargement only by provisional

means or through entire re-arrangement of the grounds (for which, at some future time, plans are prepared in detail), necessarily prevents any considerable annual increase in the number of plants used for this purpose; but this restriction of their number has been met, year by year, by increase in their variety and attractiveness, by the adoption of purposeful combinations of species, contrasted groups of related forms by which attention may be centered on them in their general characters, and by the combination of this synoptical idea in a broader way with the plans for decorative effect, whenever this can be done. In the year just closed, therefore, the out-of-door decorative features have been little different from those reported a year since, except for changes in bedding design and substitutions in the plants employed in carrying it out. As for several years past, tulips formed the attractive feature of early spring, when the parterre was planted solidly with them, the collection of these bulbs comprising 229 species or varieties, represented by 23,750 individual plants. Later in the season, the same space was used for the presentation of a contrasted collection of the choicest lantana varieties, which, though for the most part too heavily beset with foliage for a proper balancing of their flowers, proved attractive as well as interesting and instructive. Through the interest of an amateur in the cultivation of cannas, Mr. L. D. Yager, of Alton, Illinois, the display of these showy plants has this year been doubled, and no feature of the Garden has been more admired, or more critically approved by specialists, than this collection of 160 varieties, represented by 560 massed plants. Chrysanthemums were again grown in large numbers, and through the fortnight beginning with November 9th, a tented display was made of 452 varieties, represented by 3,582 plants, many of them of unusually good size and quality.

The addition of twenty acres to the Garden in 1900* not only added nearly one-half to the original area of the grounds (44.7 acres), but made possible the realization of one of the early-declared policies of the Board, to present a segregated representation of the plants of the United States; of these

* Rept. Mo. Bot. Gard. **8**: 38. **11**: 14. **12**: 11. **14**: 14. **17**: 16.

about 1,150 species are now grown in a park-like synopsis that is yearly increasing in attractiveness and interest.

One of the most pressing needs of the Garden is that of additional plant houses, for the display as well as for the cultivation of plants which require shelter,—the number of which, as the smoke of the city increases, is destined to become greater year by year. During the past twenty years the original antiquated plant houses have been supplemented by a somewhat greater area of houses, either of good modern type and construction, or temporarily but adequately built for the propagation of plants. One such house was built in 1895 for the growth of vegetables and grapes under glass; and a similar house, covering 875 square feet of ground, originally built by Dr. von Schrenk for his personal use, has been transferred to the Garden recently for experimental purposes. The present ground area of plant houses is 33,055 square feet, and the area of propagating frames and pits is 5,866 square feet; but everywhere the plants are overcrowded, and such collections as that of *Agave* are suffering from inadequate housing.

Though two serious fires have occurred in the plant houses at the Garden, in 1902* and 1903,† the losses experienced were not only quickly made good but brought expressions of sympathy and gifts of plants from so many friends as to make it questionable whether the accidents were real misfortunes.

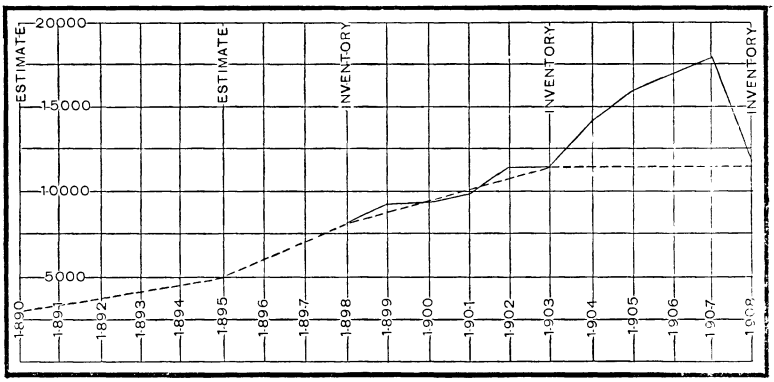
Plant and seed accessions for the year, aside from Garden propagations and collections, number 323 entries, comprising 10,044 plants or packets of seeds. Of these, 7,591, representing 277 of the entries and valued at $607.70, were presented or received by way of exchange, and 2,453, representing 44 entries, were bought, the Secretary's books showing an expenditure of $432.47 for such purchases and incident expense. The collections by Garden employees, apart from seeds gathered for exchange use, number 2,183 plants, valued at $177.21, and 101 packets of seeds, valued at $10.30. Garden propagations amount to 40,125 plants, valued at $2,808.75 and 6,860 seedlings, valued at $343.00.

The exchange seed list issued by the Garden last winter

* Rept. Mo. Bot. Gard. **14**: 14. † *l. c.* **15**: 21.

includes 1,963 species or varieties; and 6,194 packets of these seeds, valued at $309.07 have been sent to correspondents. Living plants to the number of 217, valued at $22.90, have been distributed in like manner. Aside from these exchange distributions, 320 duplicate plants and 1,364 bedding plants removed from the grounds in autumn, or remaining unused on completion of the spring planting, were given to the public schools. The surplus chrysanthemum plants which remained fresh at the end of the November exhibition, and many cut flowers from it, were presented to hospitals and other charities, 180 plants having been so distributed.

DIAGRAM A.



SPECIES AND VARIETIES CULTIVATED

The plant records for the past year show that 1,080 species or varieties not cultivated in 1907 were added, and 719 lost or discarded,—a net gain of 361, bringing the nominal number in cultivation up to 18,277, in contrast with the 17,916 reported a year ago.* It appears from the appended diagram (A) that no period in the history of the Garden has been marked by so great progress in this direction as the four years from 1903 to 1907. A quinquennial inventory, however, shows that the number of forms cultivated to-day is only 11,464, essentially the same as five years ago (11,357), so that no actual pro-

* Rept. Mo. Bot. Gard. **19**: 13.

gress has been made in this direction. The difficulties of the plant recorder in ascertaining and entering the disappearance of each species dropped, were indicated in the last general summary;* but they have never proved so misleading as during this last period of merely apparent progress notwithstanding unusual efforts to increase the collection.

THE WEATHER.

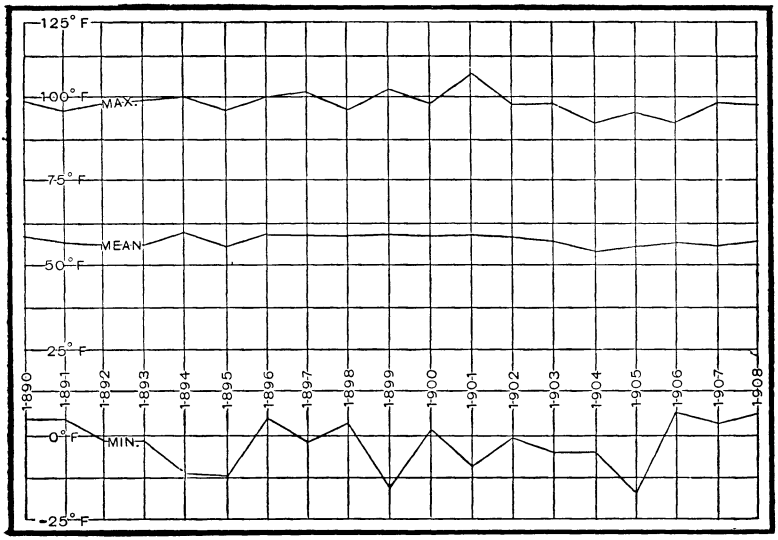
Gardening is so closely governed by and dependent on climatic conditions that success or failure, either general or partial, is often distinctly in relation with the meteorology of a given year. Though hardly a season passes without a serious thunder-storm or hail or sleet storm, which leaves in its wake washed walks, broken or riven trees, or other ruined plants, the Garden has suffered from few really serious storms since its care was assumed by the Board. One cloud-burst, in July 1893, brought so heavy and rapid a downpour as to fill the parterre with water and convert the grounds at the north of it into a pond that became nearly waist-deep where dammed by the east and north walls of the Garden, notwithstanding the existence of drains which quickly remove the water of ordinary storms; yet little harm was done aside from denudation of the steeper walks†. Two hail storms of unusual severity, one in 1896‡ and the other in 1902, did serious damage to plants and glass houses. The only really notable storm, however, was the tornado of May, 1896,§ which in addition to injuring some of the buildings, wrecked a very large part of the trees of the Garden, destroying an effect of maturity that can be reproduced only in part and after the lapse of many years.

The ordinary facts of temperature and precipitation, which have been graphically presented year by year, are epitomized in the accompanying diagrams (B and C); those of the year 1908 being shown in separate diagrams (D and E). The data used for these are derived from the records of the St. Louis office of the Government Weather Bureau, with which the

* Rept. Mo. Bot. Gard. **15**: 17.
† Rept. Mo. Bot. Gard. **5**: 14.
‡ *l. c.* **8**: 18.
§ *l. c.* **14**: 14.

readings at the Garden usually prove to be in close agreement though suburban conditions are almost invariably revealed

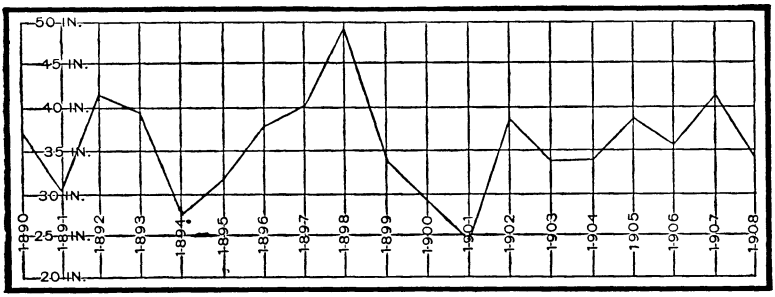
DIAGRAM B.



SHADE TEMPERATURE, 1890 TO 1908.

by greater temperature extremes at the Garden. A rather full analysis of the meteorology of St. Louis, given by Dr.

DIAGRAM C.

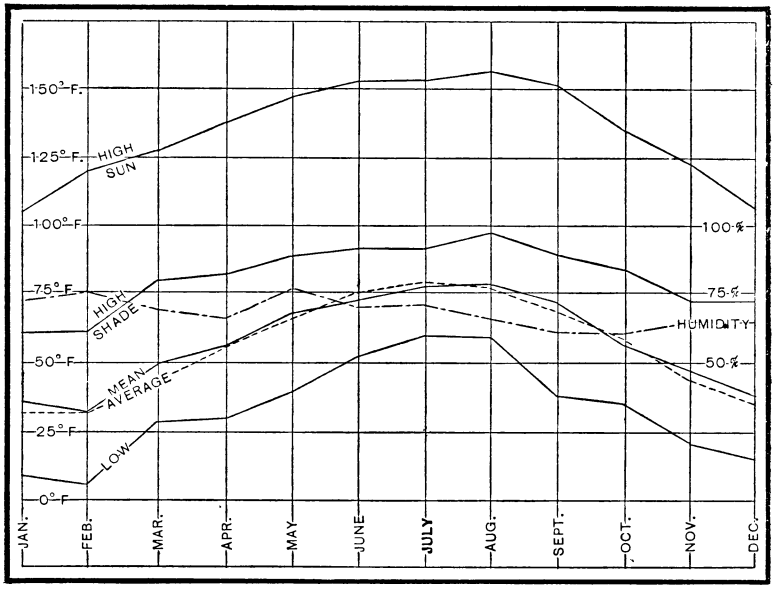


PRECIPITATION, 1890 TO 1908.

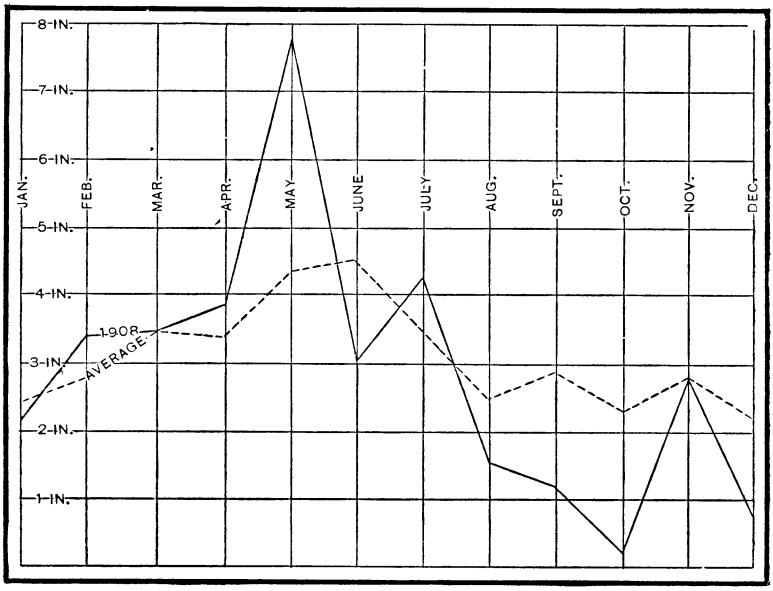
Hus in his study of the local flora in an earlier Report,* is available for comparison.

* Rept. Mo. Bot. Gard. **19**: 128. (1908).

DIAGRAMS D AND E.



D.—TEMPERATURE AND HUMIDITY, 1908.



E.—PRECIPITATION, 1908.

VISITORS.

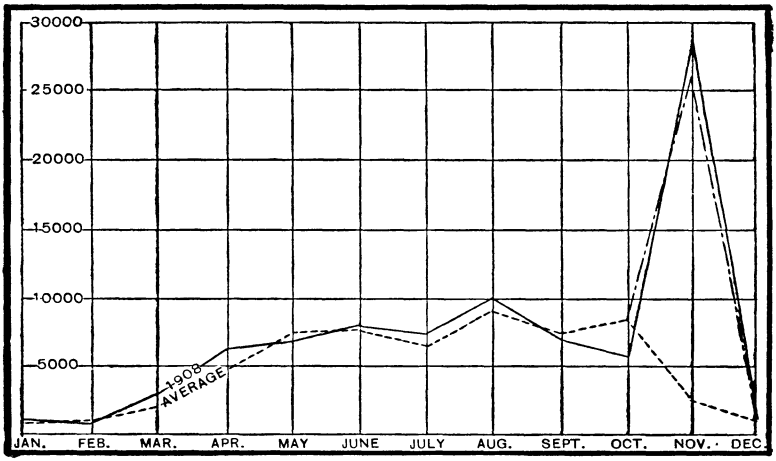
One index of the extent to which the Garden is meeting the wish of its founder to provide an attractive and interesting as well as an instructive collection of plants, for the public, is afforded by the number of visitors. In 1908 these numbered 118,465, of whom 16,659 were counted on the Sunday afternoon in June, and 17,312 on the Sunday afternoon in September, when the Garden was open under direction of Mr. Shaw's will. Of the remaining 84,494, who came on week days, some 3,000 were specially attracted by the tulips at the end of March, and 28,079 came to see the chrysanthemums in November. As in the two preceding years, Captain Robert McCulloch, of the United Railways Company, lighted the chrysanthemum tent during the fortnight of the exhibition, thus not only ensuring sufficient light on dull and stormy days, but making it possible once more to open this part of the Garden in the evening; thereby enabling 7,528 persons, many of whom could not have come in the daytime, to see the collection. The seasonal distribution of week-day visitors is graphically shown in the appended diagram (F) on which the average for earlier years (except 1904)* has also been shown, the November average for 1905–1907 inclusive being separately indicated in a broken line.

At the beginning of the year, a new and revised edition of the little Souvenir Handbook of the Garden was placed on sale at the gate, and 642 copies of it have been sold to visitors.

Sunday visitors who, according to the chance condition of the weather on the two open Sunday afternoons, fluctuate much in number from year to year, are recorded, and their ratio to the total is indicated, on a separate diagram (G). Though differing greatly year by year, this number appears to be gradually if only slightly increasing. During the time that the Garden has been under the care of the Trustees over half a million people have taken advantage of the privilege of visiting it on Sunday afforded by the special provision of

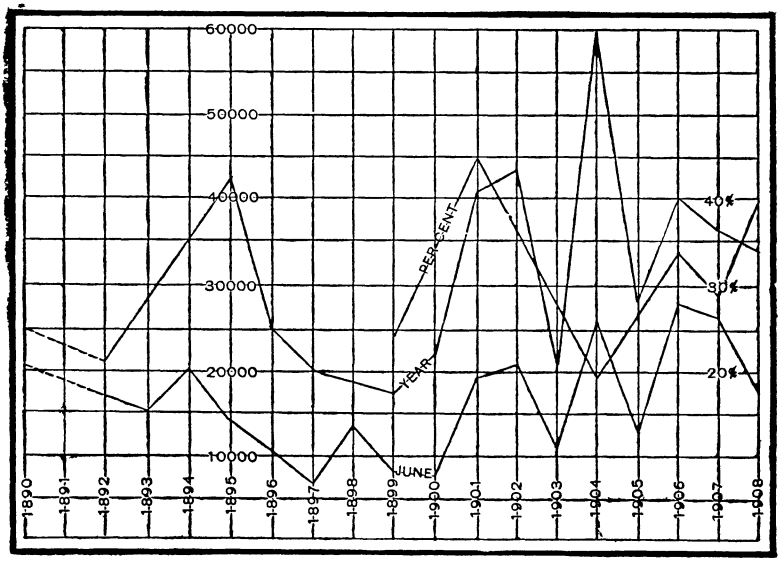
* Rept. Mo. Bot. Gard. **16**: 17.

DIAGRAM F.



WEEK-DAY VISITORS, 1908.

DIAGRAM G.



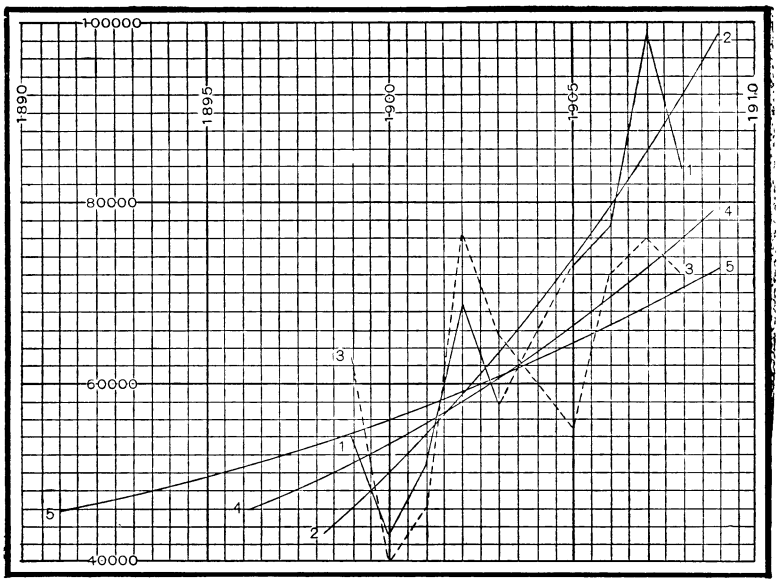
SUNDAY VISITORS, 1890 TO 1908.

IN CHRYSANTHEMUM TIME.

Mr. Shaw's will opening it on two Sunday afternoons each year.

The number of week-day visitors varies so largely, year by year, as to make an analysis of their yearly increase or decrease difficult; but an appended diagram (H), covering the period for which accurate records are available, shows in the line 1 (which is closely equivalent to the curve 2)* a decided average

DIAGRAM H.



INCREASE IN WEEK-DAY VISITORS.

yearly increase for the past decade. No small part of this is due to the chrysanthemum exhibitions, begun in 1905, and, to a far less extent, the tulip display, begun in 1904. As not directly affected by these, the July visitors—always fewer than in any other month of the summer season, and perhaps most indicative of the interest taken in the Garden by the average citizen—have been plotted on a ten-fold scale in the line 3 (roughly equivalent to the curve 4).* It is gratifying to

* The World's Fair year, 1904, being ignored

observe that even the latter shows a far more rapid proportionate rise than does Mr. Robert Moore's population curve for the city*, which is here plotted (5) on a scale of one-tenth, for comparison.

These curves seem to show that the week-day visitors have doubled in the past ten years, and that, apart from those who come to see the specially announced tulips and chrysanthemums, the Garden as a whole is not only holding its own in attractiveness in comparison with the growth of the city but is gaining in interest greatly beyond the increase in population; the July visitors having increased 47 per cent in a period during which the population has increased 25 per cent.

BUILDINGS.

During the entire period here passed in review, administrative, educational and research work at the Garden have been carried on with maximum economy of expenditure. When the Board assumed the care of the institution the Director's office was established in his residence and the dilapidated little museum collection which had been maintained in the building erected for such use in 1859 was replaced by the enlarged library and herbarium—for the original accommodation of which small rooms had been set apart when the building was planned. When the city residence of Mr. Shaw was removed to the Garden in 1891†, the offices, library and herbarium were transferred to it, and the museum building was again free; but before a collection could be displayed in it an overflow had begun, which has caused it to be again filled to the eaves with books and herbarium specimens, as in the case of the rebuilt city home. During this entire period, the only room set apart specifically for laboratory use has been a basement room of the museum building, which was equipped as a phyto-chemical laboratory in 1903‡, and as such has since been in constant use.

---

* MS., 1906; data published in Journ. Ass. Engineering Socs. **33 : 299.**

† Rept. Mo. Bot. Gard. **3 : 7**, 15.

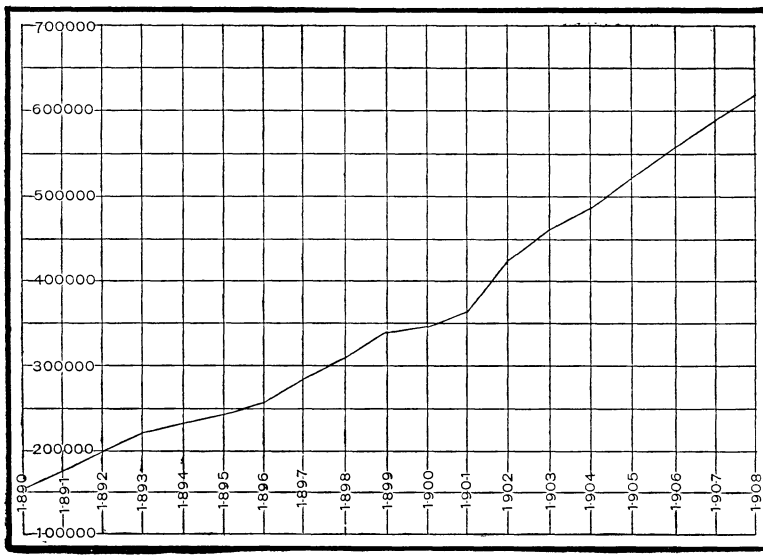
‡ Rept. Mo. Bot. Gard. **15 : 31. 16 :** 25.

The time having come when an increase in the buildings at the Garden was absolutely necessary, the first part of a quadrangle located in accordance with the plans of the landscape architects of the Board has been erected this season. The architectural motif is derived from the rebuilt city home of Mr. Shaw, which is made a part of the system. The building, of reinforced concrete, brick and terra-cotta construction, promises to afford safe and convenient housing for the library and herbarium for a number of years; and a part of it has been planned with reference to laboratory use.

THE HERBARIUM.

One of the essentials of a botanical establishment, a collection of dried plants representative not only of the general

DIAGRAM I.



INCREASE IN HERBARIUM.

floras of different regions, but of the various forms under which individual species occur, had sufficiently attracted Mr. Shaw's attention to lead him to purchase the nucleus for

such a collection many years before his death. To this, the Bernhardi herbarium of some 60,000 sheets,* have been added the much larger collection of Engelmann, the material accumulated through the life-long activity of several other prominent botanists, and the usual current sets made by professional collectors in this country, and, to a less extent, abroad. The growth of the herbarium, uniformly sustained through the last five years, is indicated by the accompanying diagram (I).

Incorporated additions for 1908 number 23,726 sheets of specimens, of which 8,984, mostly unmounted and valued at $449.20, were presented or received by way of exchange; 1,917, valued at $95.85, were collected by Garden employees; and 12,825 were purchased, the Secretary's books showing an expenditure of $1,322.30 for specimens, and material used in mounting them. In exchange for other specimens, 1,864 duplicates, valued at $93.20, and 3 mounted sheets, valued at 45 cts., were distributed to correspondents.

As a matter of probable future interest, it is here recorded that the Lindheimer duplicates of 1849 to 1851, referred to in earlier reports,† have been distributed as follows:—

New Mexico College of Agriculture and Mechanic Arts	Agricultural College, N. Mex.
University of New Mexico	Albuquerque, N. Mex.
University of Texas	Austin, Tex.
University of Arizona	Tucson, Ariz.
University of California	Berkeley, Calif.
K. Botanischer Garten	Dahlem-Berlin, Germany.
Biltmore Herbarium	Biltmore, N. C.
J. W. Blankinship	Bozeman, Mont.
Herbier Boissier	Chambésy-Geneva, Switzerland.
Jardin Botanique de l'Etat	Brussels, Belgium.
R. Botanic Garden	Sibpur-Calcutta, India.
South African Museum	Cape Town, Cape Colony.
Field Museum of Natural History	Chicago, Ill.
Botaniske Have	Copenhagen, Denmark.
Casimir de Candolle	Geneva, Switzerland.
Natal Botanic Gardens	Berea-Durban, Natal.
R. Botanic Garden	Edinburgh, Scotland.

* Rept. Mo. Bot. Gard. **1**: 93. **2**: 25. **3**: 15. **8**: 19.

† Rept. Mo. Bot. Gard. **18**: 123. **19**: 16.

Gray Herbarium	Cambridge, Mass.
R. Botanic Gardens	Kew, England.
British Museum (Natural History)	London, England.
Ugolino Martelli	Florence, Italy.
National Herbarium	South Yarra-Melbourne, Victoria.
Instituto Médico Nacional	City of Mexico.
Museo Nacional	City of Mexico.
K. Botanisches Museum	Munich, Bavaria, Germany.
Geological Survey of Canada	Ottawa, Canada.
University of Nevada	Reno, Nevada.
New York Botanical Garden	Bronx Park, New York City.
University of Oklahoma	Norman, Okla.
Muséum d'Histoire Naturelle	Paris, France.
Academy of Natural Sciences	Philadelphia, Pa.
University of Pennsylvania	Philadelphia, Pa.
Botanic Gardens	Singapore, Straits Settlements.
Jardin Impériale de Botanique	St. Petersburg, Russia.
Botanic Gardens	Sydney, N. S. Wales.
K. K. Naturhistorisches Hofmuseum	Vienna, Austria.
Baylor University	Waco, Tex.
Smithsonian Institution	Washington, D. C.

The present composition of the mounted herbarium is:—

The Engelmann Herbarium (all groups)			97,859 specimens.
The General Herbarium:—			
Higher plants.			
The J. J. Bernhardi Herbarium	61,338		
The Henry Eggert Herbarium*	23,495		
The J. H. Redfield Herbarium	16,447		
The Sturtevant and Smith Herbarium	7,446		
The Gustav Jermy Herbarium	5,118		
The A. W. Chapman Herbarium*	3,536		
The Julien Reverchon Herbarium*	17,210		
The Nicholas Riehl Herbarium	3,359		
The S. M. Tracy Herbarium	752		
Other specimens	333,199	471,900	specimens.
Thallophytes.			
The J. J. Bernhardi Herbarium*	610		
The Gustav Jermy Herbarium	1,659		
The S. M. Tracy Herbarium	4,312		
The Wm. Trelease Herbarium	11,000		
Other specimens	31,526	49,107	
Making a total of		618,866	specimens.
Valued at		$92,829.90†	

* So far as yet incorporated.

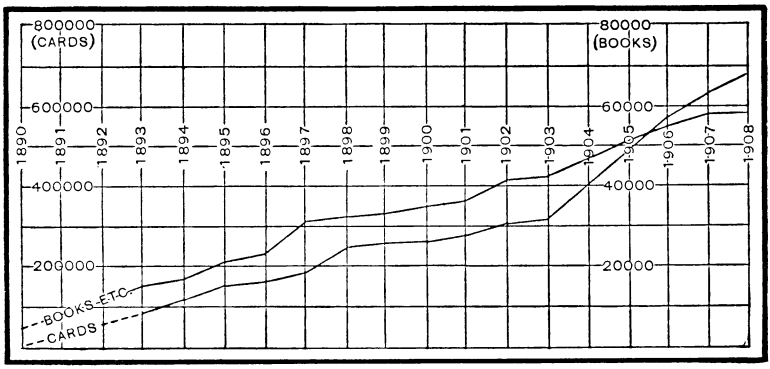
† This valuation at the rate of $15.00 per hundred mounted sheets.

Supplementing the herbarium and the shelved or incorporated exsiccatae which are here counted as a part of it,* the Garden possesses specimens of economic plant products, woods, seeds, etc., valued at $280.00, and 1,851 preparations for microscopic study, valued at $410.00, which have not received recent addition.†

THE LIBRARY.

As with the herbarium, Mr. Shaw had laid the foundation for a botanical library in a small but select collection of books

DIAGRAM J.



INCREASE IN LIBRARY.

bought many years before his death; and before the Garden came under the care of the Trustees, the library of Engelmann had been transferred to it. Though the funds available for purchasing books have necessarily been greatly limited, not a year has passed without the acquisition of choice and rare publications, and the exchange relations established and maintained with other publishing institutions have ensured the receipt of a large number of important serials without direct expenditure. The yearly details of the growth of the library from something less than 5,000 books and pamphlets,

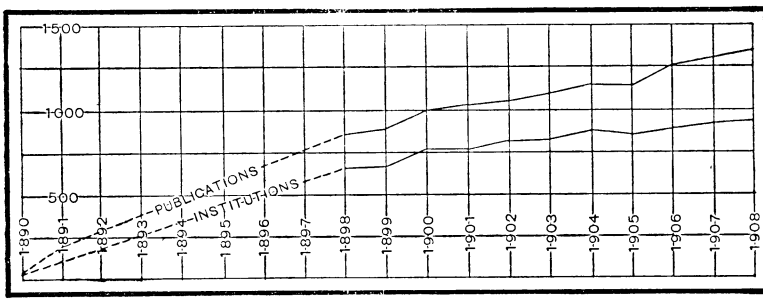
* See Rept. Mo. Bot. Gard. **16**: 21.

† See Rept. Mo. Bot. Gard. **18**: 20.

in 1889, to the present number, 58,538, are indicated in the accompanying diagram (J); rather more than the average increase being shown for the last five years.

In the year just closed, 1,289 books and 3,908 pamphlets have been added to the library; of these, 856 books, valued at $1,914.85, and 3,786 pamphlets, valued at $559.25, were presented or received in return for publications of the Garden; and 433 books and 122 pamphlets were bought, the Secretary's books showing an expenditure of $2,436.51 for purchases and binding. The customary attention has also been given to indexing publications in the library for certain features; and 43,923 new index cards have been incorporated, of which 33,433 were written by employees and the remainder purchased. The increase in cards is shown comparatively on diagram J; the great activity of the last five years being due to special effort in indexing the literature of floral ecology and seedlings.

DIAGRAM K.



INCREASE IN LIBRARY EXCHANGES.

The enumeration of books and pamphlets, in the yearly records of additions to the library, is necessarily nominal in that, when eventually bound, several thin numbers of a series are not infrequently joined together, thus reducing the number of volumes actually standing on the shelves, though without affecting their recorded valuation. The record of books and pamphlets has now been corrected by a recount, the total showing an apparent loss of 311 books and manuscripts and a gain of 616 pamphlets for the past year, although, as stated above, 1,289 books and 3,908 pamphlets have been

added. As now constituted, and after such revision, the library contains:—

Pamphlets	34,351			
Books	24,085			
	58,436, valued at			$91,283.39
Manuscripts:				
Engelmann, Notes and Sketches	60, valued at		$600.00	
Roetter, Sketches	1 " "		100.00	
Shaw, Notes	5 " "		100.00	
Sturtevant, Index Rerum	11 " "		110.00	
Price, Bird and Insect Sketches	2 " "		250.00	
Leconte, Insect Sketches	8 " "		225.00	
Bay, Bibliotheca Riviniana	1 " "		25.00	
Theses by Garden Pupils	6 " "		6.00	
Theses by Graduate Students*	8 " "		8.00	
	102 " "			$1,424.00
Total	58,538 " "			$92,707.39
Index cards	673,844 " "			6,738.44
Total value of Library				99,445.83

When the Garden came under the care of the Board it was scientifically unproductive, and without affiliations. With the issue of its first Annual Report (1890), which was purely historical, relations with other establishments were inaugurated, and the publication in each subsequent year of a volume in large part devoted to scientific papers, has made it possible to extend these relations and to develop a systematic and mutually helpful exchange of publications, the growth of which is indicated on the accompanying diagram (K).

The serial publications now received number 1,452, of which 103 are bought, and 1,349, issued by 949 institutions or publishers, are received by way of exchange. After a careful revision of the list and elimination of such as have lapsed, this number is 36 in excess of that reported last year.†

* Deposited by Washington University.

† Rept. Mo. Bot. Gard. **19**: 18. Lists are to be found in the following Reports: **10**: 91. **15**: 98.

PICKEREL WEED, PONTEDERIA CORDATA.

RESEARCH AND THE USE OF FACILITIES.

One of the explicit purposes of the founder of the Garden is scientific investigation. The means at the disposal of the Board have thus far made it possible to devote to research but a very limited part of the time of persons whose principal employment has been in the necessary care and administration of the establishment. It is, therefore, with especial satisfaction that the attention of the Board is called to the publications of the Garden staff in the series of annual Reports, and to the lists of their scientific and horticultural papers in the eighth, tenth, and fifteenth volumes, as well as that prepared for the present Report.*

From the nature of the case, research effort at the Garden has been turned thus far almost wholly to such disconnected and limited subjects as have compelled attention, rather than to larger problems requiring consecutive investigation extending over a period of years. The latter plan, whenever it shall become possible of achievement, obviously offers our greatest opportunity, but, while awaiting such opportunity, lines of work specially favored by the equipment, character, and location of the Garden have been followed. Aside from the privilege of devoting some part of their time to such pursuits, which has been granted to capable employees, the expenses of field work have been assumed by the Board on a number of occasions. In addition to the scientific results which have been acquired through field exploration, the herbarium and plant-houses have been enriched to an extent at least equaling the expenditure. In considering future development of research work in botany, the necessity of organizing a permanent staff whenever the revenue of the Board shall make this possible is apparent, thereby making it practicable to co-ordinate such individual work as may be assigned to advanced students as contributions to the solution of larger scientific problems requiring continuous investigation. While awaiting this desirable increase in the staff of local workers, effort has been directed to securing an adequate

* Rept. Mo. Bot. Garden. **8**: 221–232. **10**: 85–90. **15**: 87–97.

equipment, with the result that the material resources of the Garden are already large and reasonably well balanced. From the beginning, the fixed policy has been to make all our resources freely available for the use of botanists who must of necessity prosecute their studies elsewhere, and to afford every possible facility to investigators who can spend even a short time at the Garden in rounding out their work. This service has been rendered without charge beyond the expense incident to transporting books and specimens. Inspection of the series of Garden Reports and of the publications of the national Bureau of Plant Industry, gives a partial indication of the extent to which the equipment has been thus utilized. In the year just closed 301 books have been loaned from the library, to 72 persons or institutions; and 19,348 sheets of herbarium specimens, to 31 borrowers.

By authorization of the Trustees, a botanical research table was maintained in the Marine Biological Laboratory at Wood's Hole for three years, and utilized by an appointee of the Garden; but it was found necessary to discontinue this provision.*

THE HENRY SHAW SCHOOL OF BOTANY.

In 1885, four years before the Garden passed under the care of the Board of Trustees, Mr. Shaw endowed a School of Botany in connection with Washington University and declared his intention to provide for its intimate relation with the Garden†,—an intention which he fully carried out.‡ The property devised, then yielding an annual income of something over $5,000.00 and guaranteed not to fall below $3,500.00 annually, though nominally an endowment of a school of botany, is virtually that of a chair of botany.

Through the assumption of a large part of the Director's salary by the Garden Board, in 1893§, it has been made possible for the University to secure adequate and capable associates to relieve him of the details of undergraduate instruction, while the facilities of the Garden have been fully

* Rept. Mo. Bot. Gard. **4**: 16. **5**: 17. **6**: 16. **7**: 19. **8**: 22.
† *l. c.* **1**: 56–59. ‡ *l. c.* **1**: 36, second clause. § *l. c.* **5**: 21.

utilized in class work. An amplification of the scope of the chair of botany into that of a real school of botany rests logically on the specific authorization of Mr. Shaw's will in connection with enlargement of the research activities of the Garden. It is a matter for congratulation that the enormous burden of special taxation, which has thus far so greatly hampered the Trustees in every direction, is likely to be lifted within the next five or six years—through completion of the city improvements for which unproductive revenue property is taxable. It should be possible, then, to make the School of Botany in fact what it is now in name, within at most a decade. No extension of the activities of the Garden is likely to yield so large or significant results as are to be anticipated from a Faculty of botany devoted to research and guiding younger investigators in utilizing the Garden equipment.

While financial conditions have thus far made it impossible for the School of Botany to undertake much beyond meeting the undergraduate botanical needs of the University, these have been fully met. With the personal approval of Mr. Shaw, an evening course in medical bacteriology was conducted in the years 1888–9 and 1889–90,—paving the way for such courses in the medical schools of the city; and special laboratory and lecture instruction in various other branches of botany has been given from time to time. Applicants for graduate standing have also been given opportunity for such work as lay within their powers and the equipment of the University and the Garden; and, though few in number, the six persons who have earned the Master's degree and the nine who have earned the Doctor's degree, with botany as a major subject, have demonstrated by subsequent achievement the value of the training that they have received, even under existing conditions.

In the year just closed, the undergraduate work of the School of Botany has essentially repeated that of the preceding year.* At the opening of the current College year, Mr. Arno Nehrling was appointed to the position of Assistant, which Mr. W. A. Ruth had filled last year.

* A list of electives offered, is given in Rept. Mo. Bot. Gard. **19**: 20.

The enrollment for the first term of 1908–9 was:—"Biology 1," 2; "Botany 1," 12; "Botany 7," 6; "Botany 11," 6;—a total of 26 students, of whom the two first noted give about equal time to botany and zoology, and the others take one full botanical course each. With the present term, in connection with the extension work of the University, for which the regular electives are opened, the School of Botany has resumed the practice of offering special courses of instruction to teachers and others not matriculated as candidates for degrees—begun in 1885* but discontinued by direction of the Advisory Board in 1893,† though occasional courses of the kind have been given by request in the intervening years.

At the last Commencement of Washington University, the degree of Doctor of Philosophy, with botany as a major study, was conferred upon Mr. Henri Hus, whose thesis is published in the last Report of the Garden.‡ There is now registered at the University one candidate for the Master's degree, with major work in botany.

GARDEN PUPILS.

In pursuance of an express provision by Mr. Shaw that instruction to garden pupils be attended to, and guided by memoranda left by him, though not incorporated in his will, the Trustees early established six scholarships for ensuring to the holders a broad education in the principles and practice of gardening, without expense.§ The prescribed work was subsequently opened to others on the payment of a nominal tuition fee.¶ One paying pupil is now enrolled.

The course of study, originally made to cover six years,*[1] was reduced to four years and published in detail in 1892,†[1] since which, aside from minor modifications and readjustments, it has been little changed. As now given, the course is as follows:—

---

* Rept. Mo. Bot. Gard. **1**: 84.
† *l. c.* **5**: 22.
‡ *l. c.* **19**: 127–258. *pl. 13–20.*
§ *l. c.* **1**: 94.
¶ *l. c.* **6**: 21.
*[1] *l. c.* **1**: 95.
†[1] *l. c.* **4**: 17-18.

COURSE OF STUDY.

YEAR.	TERM.	STUDIES.					PER WEEK.
SECOND.	April to June.	Floriculture. 3 exercises weekly.		Orchard Culture. 1 exercise weekly.	Surveying. 2 exercises weekly.		6
	July to Sept.	Floriculture. 3		Book-Keeping. 1	Landscape Gardening 2		6
	Oct. to Dec.	Floriculture. 1	Economic Entomology. 2		Surveying. 1	Elementary Botany. 3	7
	Jan. to Mar.	Floriculture. 1	Economic Entomology. 2	Twigs of Woody Plants. 1		Elementary Botany. 3	7
THIRD.	April to June.	Vegetable Gardening 3	Economic Entomology. 2			Botany of Wild Flowers. 2	7
	July to Sept.		Economic Mycology. 1	Orchard Culture. 2	Landscape Gardening 1	Botany of Garden Flowers. 2	6
	Oct. to Dec.		Economic Mycology. 3	Garden Accounts. 1	Botany of Fruits. 2		6
	Jan. to Mar.		Economic Mycology. 3	Garden Accounts. 1		Botany of House Plants. 2	6
FOURTH.	April to June.		Forestry. 1		Surveying and Drainage. 3	Botany of Woody Plants. 2	6
	July to Sept.	Small Fruit Culture. 4			Botany of Weeds. 1	Botany of Vegetables 1	6
	Oct. to Dec.	Special Gardening 2	Forestry. 1	Book-Keeping. 1	Orchard Culture. 1	Vegetable Physiology 2	7
	Jan. to Mar.	Special Gardening 2	Forestry. 1	Botany of Ferns. 1	Botanical Geography 1	Vegetable Physiology 2	7

The 77 class exercises per week here tabulated (each extending over three months), may be grouped under subjects as follows:—

Gardening:			
Floriculture	8		
Vegetable gardening	3		
Fruit culture	8		
Forestry	3		
Landscape gardening	3		
Selected thesis work	4	29	
Surveying and drainage		6	
Bookkeeping and accounts		4	
Economic entomology		6	
Botany in its relation to gardening:			
General botany	8		
Botany of decorative plants	5		
Botany of hardy woody plants	3		
Botany of fruits	2		
Botany of vegetables	1		
Botany of weeds	1		
Botanical geography	1		
Economic mycology	7		
Vegetable physiology	4	32	77

All of the above subjects capable of being taught in the laboratory, the greenhouse, or the field, are so taught; and all of the theoretical instruction is expected to be practically tested in the performance of the manual work required of students.

By action of the Corporation of Washington University, the classes of the School of Botany are opened to garden pupils, who are also granted free instruction in entomology at the University; and by special permission they have been admitted occasionally to other college classes. Though they show as great differences in preparation, ability, and studiousness as other young people, the garden pupils in the main have been of excellent character, and, though a high-school education is not expected of them, a number have come to the Garden with such preliminary qualification, and as a rule they have stood well up in such college classes as they have entered,

although giving the greater part of their time and energy to garden manipulation and the direct study of this art.

Though the immediate purpose of the course has been to train practical gardeners, and a majority of those who have completed it are now successful gardeners or florists, several have assumed responsible positions in the care of parks or school grounds, others have gone into government botanico-horticultural work or forestry, two have succeeded to an unusual degree in professional landscape work, and two have become college teachers of horticulture.*

The past year has seen no change (aside from a slight readjustment of studies) in the work of garden pupils, and no changes have been made in the teaching force. An important change in conditions, in some respects regrettable, has been necessitated, however, by the removal of the building which has heretofore served as a home for the pupils. This building,—erected by Mr. Shaw opposite the entrance to Tower Grove Park, and rented during his life-time for use as a restaurant,—no longer fitting into the plans of the Garden, and being dilapidated, was removed in the spring of 1908. As it has not been found expedient to provide another building in which pupils may be lodged, the allowance of money carried by the scholarships has been increased by the amount formerly spent on the maintenance of the lodge, and the pupils now find lodgings at pleasure in the neighborhood of the Garden. Each scholarship, in addition to free tuition, now carries a money grant of $330.00 for the first year, and $380.00 for each of the remaining three years. Two pupils are expected to have completed the required work by March next, and an announcement has been issued, offering the vacated scholarships in accordance with the provisions made by the Board.

THE GARDEN STAFF.

If unusual attention be here drawn to the men who have been concerned with the operations of the Garden for the past two decades, warrant is to be found in the express injunction of its founder that the Director shall so employ his energies,

* See Rept. Mo. Bot. Gard. **17** : 21.

that from year to year the institution shall grow up in efficiency in promoting the ends in view in its inception,* and the corollary that such efficiency must always result largely from his official associates. To them are due directly improvements in gardening methods and design, increase in the variety and attractiveness of plants cultivated, adaptation of this collection to the purposes of education and research, care of the enormously enlarged library and herbarium adequate to their preservation and utilization, and personal aid rendered to the hundreds of visitors and correspondents whose botanical and horticultural questions are answered each year. That few of these collaborators could be retained in positions commensurate with their maturing qualifications for filling them has been our misfortune rather than theirs, but it is gratifying to know that their services while here not only resulted in the specific ends contemplated, but have also largely contributed to their own advancement. In the year just closed, three such losses have been experienced. At its beginning Dr. Harris, who had served as librarian since 1904, withdrew, to devote his entire time to research work with the Carnegie Institution; and towards its end Dr. Hus, who had spent three years in experimental work at the Garden, accepted an instructorship in the botanical department of the University of Michigan. The position of Library Cataloguer which Miss Smoot had held efficiently for over a year was also relinquished in the autumn, and her duties, with responsible care of the library, have been assumed by Miss Cora Hogan, who had familiarized herself with them under Miss Smoot's direction during the earlier part of the year.

The professional activity of the Garden staff during the past five years is indicated in a list of publications to which reference has already been made, 107 of the 153 recorded titles being those of publications by employees or pupils of the institution.

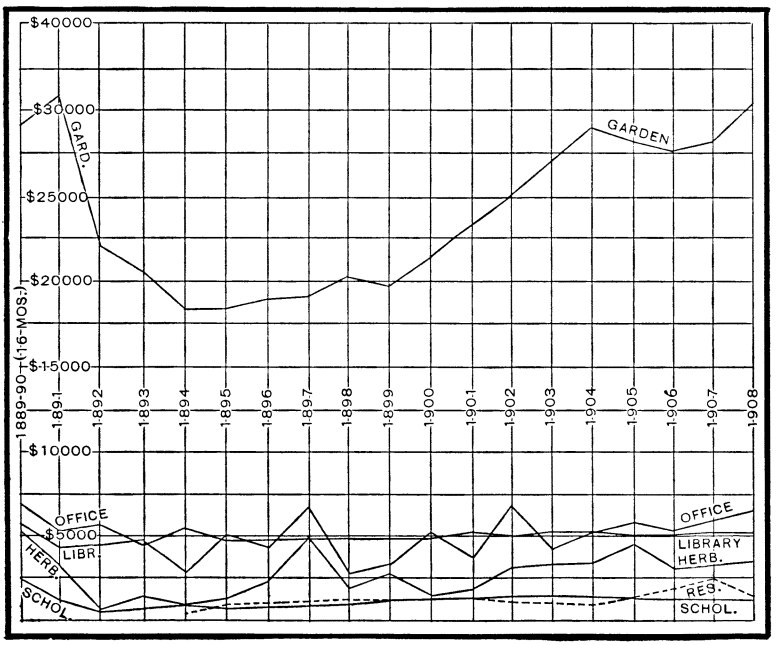
MAINTENANCE EXPENSE.

The expenditures for maintenance of all departments of the Garden, as tabulated in the annual statements of the Secretary,

* Rept. Mo. Bot. Gard. **1**: 35.

are shown comparatively in the appended diagram (L). The size and fluctuations in the largest item, for maintenance of the Garden itself, are especially instructive. During the first years of administration, owing to a large arrearage of deferred repairs, this item stood at about $30,000.00 a year, from which, by 1892, some $8,500.00 had been subtracted. The next two years saw a further reduction of about $1,700.00 each, chiefly through better organization and greater intelligence in

DIAGRAM L.



MAINTENANCE EXPENSES.

the help employed. The minimum, of $18,500.00 to $20,000.00, was maintained until 1899, notwithstanding the addition of a small plant house and provision for increased use of city water in 1894* and 1895,† and a considerable enlargement of the ordinary plant houses in 1897.‡ Further additions to the houses

* Rept. Mo. Bot. Gard. **6**:14. † *l. c.* **7**: 14–16.
‡ *l. c.* **9**: 14.

in 1900* and 1902,† and the subsequent provision of several temporary houses for the growth of chrysanthemums, as well as the maintenance of the North American synopsis since 1901, the systematic collection of seeds for exchange since 1905,‡ and a progressive and notable increase in the wages paid gardeners during the past five years to meet increased cost of living, have caused the original scale of maintenance expenditure to be again reached. Indeed, it is only through undesirable economies that the $30,000.00 mark has not been considerably overstepped every year since 1904—as it must be from this time on.

In comparison with the necessarily increasing item for gardening, the other maintenance expenses have remained relatively small and constant. The expenditure on research and the instruction of garden pupils has changed little, year by year, except during the period of Dr. Harris' connection with the library, when the charging of a considerable part of his salary to the former account increased the figures. The amount spent on both library and herbarium have varied more, following greater or smaller additions of books and specimens. The maintenance of the building erected during the year just closed must appreciably increase the future fixed charges on both the library and the herbarium account, to which I hope to see laboratory expenses added. Because of the large proportion of the Director's salary so charged, the office expenses have always been relatively large, but they have run fairly uniformly until 1907, when a readjustment of this larger item carried them to a higher level, which they are likely to follow for some years with little change.

The relation of values to total expenditure on the library and herbarium would afford an interesting detailed study, but this is reserved for a future analysis. It is sufficient to state here that Mr. Shaw's purpose to establish exchange relations between the Garden and other scientific establishments—thus far effected mainly through the annual Report of the Garden, the seeds gathered for distribution to correspondents, and occasional accumulations of living plants and

* *l. c.* **12**: 13. † *l. c.* **14**: 14.
‡ *l. c.* **17**: 29. **18**: 14. **19**: 12. **20**: 14.

of herbarium specimens in duplicate—has resulted not only in making the activities of the Garden generally known, but also in material acquisition in excess of the cost of maintaining the exchanges.

SPECIAL TESTAMENTARY PROVISIONS.

Four annual events are specifically provided for in the will of Henry Shaw, in connection with the administration of the Garden: a banquet to the Trustees and invited guests; a banquet to the gardeners of the institution and invited florists, nurserymen and market gardeners; premiums or prizes to be offered at a flower show held in St. Louis; and a sermon on the wisdom and goodness of God as shown in the growth of flowers, fruits and other products of the vegetable kingdom. These have received the attention of the Board each year in a manner consonant with the purposes of the testator and calculated to advance the usefulness of the Garden, and have been mentioned in the administrative reports, year by year. In 1908 three of these specific bequests were utilized.

The flower sermon was preached in Christ Church Cathedral, St. Louis, on the morning of May 17th, by the Right Reverend E. W. Atwill, Bishop of West Missouri.

The Nineteenth Gardeners' banquet was given at the Mercantile Club on the evening of August 12th, 1908. There were present 140 persons, of whom about one-third were members of the American Apple Growers' Congress, which was then meeting in St. Louis. Under the provisions of Mr. Shaw's will, the Director of the Garden presided. Appropriate speeches were made by Captain George T. Lincoln, of Bentonville, Arkansas, President of the Arkansas Horticultural Society; Honorable Nikola Kaumanns, of Chicago, Imperial German Agricultural Attaché to the United States; Mr. C. H. Thompson, of the Garden; President L. A. Goodman of the American Pomological Society; Mr. Anton Oppermann, Secretary of the Gardeners' Association of St. Louis; Professor H. M. Whelpley, of Washington University, and Honorable Norman J. Colman, former United States Secretary of Agriculture.

The floral premiums were again awarded through the St. Louis Horticultural Society, at an exhibition held in St. Louis from the third to the sixth of November, 1908.

While it is probable that the money which has been spent on these annual events specially designated by the founder of the Garden would have been used for other purposes thought to be more immediately necessary, if the decision had rested with the administration of the institution, there is reason to believe that its general advancement has been sufficiently favored by them to show clearly the wisdom of Mr. Shaw in specifically providing for them.

Very respectfully,

WILLIAM TRELEASE,
Director.